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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/688,589	10/16/2003	Sang-In Han	001.3000	2253

29906 7590 06/06/2005

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EXAMINER

ROSASCO, STEPHEN D

ART UNIT	PAPER NUMBER
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1756

DATE MAILED: 06/06/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/688,589

Applicant(s)

HAN ET AL.

Examiner

Stephen Rosasco

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 13 April 2005.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-29 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-29 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 10/16/03 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date 4/13/05, 10/25/04.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

Detailed Action

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1-29 rejected under 35 U.S.C. 102(b) as being anticipated by Tennant et al. (5,521,031).

The claimed invention is directed to an extreme ultraviolet (EUV) lithographic mask and a method of forming an extreme ultraviolet (EUV) mask for reflecting radiation having a wavelength less than 40 nanometers comprising the steps of: providing a substrate;

forming a first reflectance region overlying said substrate; forming an attenuating phase shifter overlying said first reflectance region wherein said attenuating phase shifter attenuates EUV radiation through a combination of destructive interference and absorption and wherein said attenuating phase shifter is less than 700 angstroms thick; and forming a plurality of openings through said attenuating phase shifter to expose said first reflective region.

And wherein said step of forming an attenuating phase shifter overlying said first reflectance region wherein said attenuating phase shifter attenuates EUV radiation through a combination of destructive interference and absorption and wherein said attenuating phase shifter is less than 700 angstroms thick further includes the steps of: forming an embedded layer overlying said first reflectance region, said embedded layer being tuned to destructively interfere with EUV radiation; forming a second reflectance region overlying said embedded layer, and forming an absorber layer overlying said second

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reflectance region wherein said embedded layer acts as an etch stop when forming said plurality of openings.

Tenant et al. teach (see claims) a lithographic mask comprising a mask pattern for producing a projection image, the projection image including features of least dimension less than 0.25 μm , the mask pattern consisting of transparent regions and blocking regions for selectively transmitting and blocking delineating radiation, the blocking regions being so composed and of such thickness as to transmit a portion of incident delineating radiation, while imposing a phase delay, so that the portion is phase shifted by about 180 degree relative to that transmitted through transparent regions, whereby feature edge definition is improved by destructive interference,

wherein the mask is a reflecting mask including a reflecting substrate with its reflectivity dependent on a multi-layer distributed reflector, and in that blocking regions mask the reflecting substrate from incident radiation, the thickness of the blocking regions being such as to impose a phase shift of about 90 degree for one-way passage of radiation, in which the thickness and refractive index of the blocking regions is such as to provide this phase shift for radiation of a wavelength within the wavelength range of from 150 nm to 3 nm.

And in which the composition of blocking regions contains at least two ingredients.

And in which blocking layer thickness provides the phase shift for radiation of a wavelength within the wavelength range of 50 nm-3.0 nm.

And in which image feature dimension is less than 0.18 μm .

Tenant et al. also teach (see claims) a lithographic mask comprising a mask pattern for producing a projection image, the projection image including features of least dimension

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less than 0.25 μm , the mask pattern consisting of transparent regions and blocking regions for selectively transmitting and blocking delineating radiation, the blocking regions being so composed and of such thickness as to transmit a portion of incident delineating radiation, while imposing a phase delay, so that the portion is phase shifted by about 180 degree relative to that transmitted through transparent regions, whereby feature edge definition is improved by destructive interference.

The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. See *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and, *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent is shown to be commonly owned with this application. See 37 CFR 1.130(b).

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

Claims 1-29 are rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-12 of U.S. Patent No. 6,653,053 in view of Tennant et al. 5,521,031.

The claimed invention is directed to an extreme ultraviolet (EUV) lithographic mask and a method of forming an extreme ultraviolet (EUV) mask for reflecting radiation having a wavelength less than 40 nanometers comprising the steps of: providing a substrate;

forming a first reflectance region overlying said substrate; forming an attenuating phase shifter overlying said first reflectance region wherein said attenuating phase shifter

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attenuates EUV radiation through a combination of destructive interference and absorption and wherein said attenuating phase shifter is less than 700 angstroms thick; and forming a plurality of openings through said attenuating phase shifter to expose said first reflective region.

And wherein said step of forming an attenuating phase shifter overlying said first reflectance region wherein said attenuating phase shifter attenuates EUV radiation through a combination of destructive interference and absorption and wherein said attenuating phase shifter is less than 700 angstroms thick further includes the steps of forming an embedded layer overlying said first reflectance region, said embedded layer being tuned to destructively interfere with EUV radiation; forming a second reflectance region overlying said embedded layer, and forming an absorber layer overlying said second reflectance region wherein said embedded layer acts as an etch stop when forming said plurality of openings.

Mangat et al. essentially teaches the claimed invention.

The teachings of Mangat et al. differ from those of the applicant in that the applicant teaches that the attenuating phase shifter attenuates EUV radiation through a combination of destructive interference and absorption.

Tenant et al. teach (see claims) a lithographic mask comprising a mask pattern for producing a projection image, the projection image including features of least dimension less than 0.25 μm , the mask pattern consisting of transparent regions and blocking regions for selectively transmitting and blocking delineating radiation, the blocking regions being so composed and of such thickness as to transmit a portion of incident delineating radiation, while imposing a phase delay, so that the portion is phase shifted by about 180.

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degree relative to that transmitted through transparent regions, whereby feature edge definition is improved by destructive interference.

It would have been obvious to one having ordinary skill in the art to take the teachings of Mangat et al. and combine them with the teachings of Tennant et al. in order to make the claimed invention because it would be obvious to one to use destructive interference for attenuation in the EUV mask of Mangat et al., because the known advantage of destructive interference is that it forms a sharp boundary and is used when the greatest resolution is required.

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1-29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mangat et al. (6,653,053) in view of Tennant et al. (5,521,031).

Mangat et al. essentially teaches the claimed invention as recited above.

The teachings of Mangat et al. differ from those of the applicant in that the applicant teaches that the attenuating phase shifter attenuates EUV radiation through a combination of destructive interference and absorption.

Tennant et al. teach (col. 4, line 62-67) the blocking (or "opaque") region is a binary layer constituted of phase shifting layer 13 and attenuating layer 14. ("Phase shifting" and "attenuating" describe primary purpose. Taken together, the binary layer introduces the x phase delay with desired attenuation.) Incoming radiation is represented by rays 15 and 16,

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and reflected radiation by rays 17 and 18. Ray 15, incident on an unmasked portion of the DBR surface 19 is "totally" reflected i.e. is reflected to the full capability of the DBR. Ray 16, incident on a masked portion of the DBR surface 19, is attenuated and phase shifted during its round-trip passage through layers 14 and 13, and yields ray 18.

It would have been obvious to one having ordinary skill in the art to take the teachings of Mangat et al. and combine them with the teachings of Tennant et al. in order to make the claimed invention because it would be obvious to one to use destructive interference for attenuation in the EUV mask of Mangat et al., because the known advantage of destructive interference is that it forms a sharp boundary and is used when the greatest resolution is required.

Conclusion

Any inquiry concerning this communication or earlier communications from the Examiner should be directed to Stephen Rosasco whose telephone number is (571) 272-1389. The Examiner can normally be reached Monday-Friday, from 8:00 AM to 4:30 PM. The Examiner's supervisor, Mark Huff, can be reached on (571) 272-1385. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



S. Rosasco
Primary Examiner
Art Unit 1756

S. Rosasco
05/24/05